DOCUMENT RESUME

ED 394 787 SE 057 978

AUTHOR Bunch, Susan Malone
TITLE The Context of Community: The Initiation of Graduate Students into the Discourse of Mathematics Education Researchers.
PUB DATE Apr 95
NOTE 34p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 18-22, 1995).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *College Faculty; *Discourse Analysis; *Doctoral Programs; *Graduate Students; Higher Education; Interviews; *Mathematics Education; Observation; *Writing Processes

ABSTRACT

This study focused on four students and a professor from a mathematics education doctoral program at a research university. Participant observation, informal interviews, and document collection were used to collect data on students' discourse competency development. Two overarching categories emerged during data analysis: (1) what students had to learn in order to be competent in their discipline's discourse (identified initially as the conversations and conventions to the discipline); and (2) how the students developed these competencies, beginning with the specific learning opportunities each student had and generalizing from those to more abstract categories such as exposure, practice, feedback, and the effects of mentoring. One of the most important things these students came to recognize was the conversational nature of the discourse they were attempting to learn. The students learned to produce the discourse of the mathematics education research community through several important experiences: (1) the exposure to the products of the professional conversation; (2) the exposure to the process of conversation; (3) the opportunities to try the discourse and get feedback on their attempts to use it; and (4) the occasional explicit instruction in producing acceptable written discourse--all under the guiding hand of a mentor who was an active, influential member of the community. (MKR)

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THE CONTEXT OF COMMUNITY: THE INITIATION OF GRADUATE STUDENTS INTO THE DISCOURSE OF MATHEMATICS EDUCATION RESEARCHERS

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Susan Malone Bunch

Department of English

University of Southern Mississippi

paper presented at the annual meeting of the American Educational Research Association, San Francisco, April, 1995.

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THE CONTEXT OF COMMUNITY: THE INITIATION OF GRADUATE STUDENTS INTO THE DISCOURSE OF MATHEMATICS EDUCATION RESEARCHERS

The Problem

Recent interest in disciplinary or rhetorical communities among composition scholars, literary theorists, and sociolinguistically-oriented educational researchers has led to research focused on understanding the features of discourse as it is produced in disciplinary contexts as well as the ways disciplinary communities operate and the effect community membership may have on a writer's comprehension and production of texts. Researchers in both academic and professional contexts have considered the relationship between community membership and discourse competency and have attempted to learn how new members' initiation into discourse communities is related to learning to speak, read, and write the discourse of those communities.

This naturalistic field study explored the processes by which doctoral students are initiated into the discourse of their discipline. The research question was "How do students learn to write the documents that will establish them in their professional community?" I was particularly interested in the role the local mathematics education community played in the students' development of written discourse competency.

Background of the Study

This study is based on theoretical assumptions shared by sociolinguists (Gumperz, 1971; Hymes, 1971), social constructionists (Bruffee, 1986), and researchers in the sociology of science (Bazerman, 1981 ; Gilbert & Mulkay, 1984; Knorr-Cetina, 1981; Latour & Woolgar, 1979; Myers, 1985a, 1985b, 1991) about the relationship between texts and discourse communities and the acquisition of literacy within communities. They see texts as products of social negotiation which can only be understood in terms of the contexts in which they occur. Theorists of language acquisition see the process of literacy development as paralleling the development of speech (Goodman, 1986; Smith, 1981, 1988). Writing, like

speaking, is a social activity that takes place within communities and accomplishes meaningful social functions. Community members share tacit "rules of use" (Hymes, 1971)--linguistic, intellectual, and social conventions that govern their discourse. Newcomers to the community learn these rules gradually and largely without conscious attention through interaction with established community members and with the texts of the community.

Researchers in academic and professional settings have claimed that it is necessary for newcomers to learn not only the conventions of the discipline (Bartholomae, 1985; Bizzell 1982a, 1982b), but also the conversations of the community (Bazerman, 1981). Being able to integrate both the appropriate linguistic and rhetorical conventions and the subject matter knowledge appears to constitute a specialized form of literacy writers use in professional forums, according to Berkenkotter, Huckin, and Ackerman (1988). Herrington (1985) found that writing is not a global skill but that even within one discipline different courses may represent distinct forums with distinct conventions and expectations.

Most of the research that considers *professional* academic discourse--that "discourse of experts whose goal it is to increase the field's base of knowledge" (Anson, 1988)--has focused on the sciences (Bazerman, 1981, 1984, 1985; Gilbert & Mulkay, 1984; Knorr-Cetina, 1981; Latour & Woolgar, 1979; Myers, 1985a, 1985b; Yearly, 1981). This research confirms the socially-negotiated nature of texts (Bazerman, 1984, 1988; Myers, 1985a, 1985b; Yearly, 1981). In his case study of two biologists revising to accommodate their referees' criticisms, Myers (1985b) raises the questions, "How does a researcher learn all [the] complex conventions of the scientific article? What part do such negotiations play in the education of a doctoral student, or in the choice of problem or shifts of specialty?" (p. 628).

In Writing in the Academic Disciplines, 1897-1990: A Curricular History, David Russell (1991) points to what he calls the myth of transience (the notion that students will learn to write in one class and that writing ability will transfer to all other writing situations) and the transparent nature of writing (the notion that established members of a discourse community are unaware of the rhetorical strategies they use and therefore do not make those strategies

explicit to students) as being partly responsible for American education's failure to teach its students to write. He explains:

> Because academics and other professionals assumed that writing was a generalizable, elementary skill and that academia held a universal, immutable standard of literacy, they were constantly disappointed when student writing failed to measure up to the local, and largely tacit, standards of a particular social class, institution, discipline, or profession by which they were in fact judging that writing. (6).

In discussing graduate education in particular, Russell suggests that this myth of transience and the transparent nature of writing in the disciplines prevent any systematic teaching of writing at the graduate level and that this explains the plethora of ABD's--students finish their course work but founder when faced with the task of writing the dissertation because they have never developed confidence and competence in the discipline's discourse.

Only two studies have attempted to address the role graduate education plays in discourse community initiation. Berkenkotter, Huckin, and Ackerman (1988, 1991) followed a graduate student through his first year in a rhetoric Ph.D. program, finding that making the transition from *teacher* to *researcher* complicated their subject's attempts to integrate knowledge of the conversations of his new discipline with his newly gained knowledge of the conventions of the discipline, an integration upon which his entrance into the field was dependent. Though these researchers examined the development of their subject's writing ability *within* his discourse community, no substantial research has investigated the role the community itself plays in professional discourse development for graduate students. This community includes the student's professors, graduate student colleagues, and the "invisible college" (Crane, 1972) of researchers at other institutions who share their work with one another through the research community's "communicative forums" (Berkenkotter, Huckin, & Ackerman, 1991), publications in professional journals and papers delivered at professional meetings.

Sullivan (1988) studied graduate students in English and found that her subjects were rarely given any instruction in writing nor opportunities to discuss their writing with faculty or other students. "Students are seeking to learn discipline-specific languages that will allow

them to participate in discipline-specific conversations, but the discipline itself seems to assume that those languages have already been mastered" (pp. 217-218).

In addition to these two studies, research by Lynn Bloom (1981), who studied writing anxiety in graduate students, concludes that graduate faculty need to teach explicitly not only research methodology, but writing skills as well, because "graduate students may be more naive about research methodology and writing than they're willing to admit" (p. 113).

A pilot for the present research study was conducted during the spring semester of 1993 (Bunch). For this pilot study, I worked with doctoral students and professors in the reading education program at the same university where the present study was conducted. The findings of the first investigation helped shape my expectations for the second study. Among the reading education graduate community, I found that students' attempts to learn the discourse of their discipline were confounded by two things in particular.

First was a lack of compatibility between the writing experiences students have in their course work and those they will have in their professional writing. Both affected the students' ability to value and use rhetorical strategies and their ability to analyze an audience and adapt a piece of writing to it. The purposes for writing in course work and professional writing were different; the audiences were different; the amount of feedback and the expectations for revision were different. Students gained little experience from their course writing in being accountable to their audience or in working within the conventions that would codify their eventual audience's expectations.

Second was the absence of a sense of "writing community" among the students and professors. This could be traced, in part, to the students' belief that sharing their writing or collaborating with another student or a professor was inappropriate, that writing was a solitary activity. The narrow sense of audience also contributed to students' unwillingness to share their writing with one another. If students considered audience at all when writing their class papers, they saw the audience as the professor. This inability to see their writing as part of a

social process and as addressed to a larger community caused problems when they needed to be able to think in terms of rhetorical strategies.

I expected similar issues to emerge in the study of the mathematics education community I chose for the current study. As you will see, however, a new community brought with it new issues and findings, often surprisingly different from those that emerged from the pilot study.

Overview of the Study

This study focused on four students and a professor from the mathematics education doctoral program at a private research university. I used participant observation, informal interviews, and document collection to collect data on these students' discourse competency development, then analyzed the data using the constant-comparative method developed by Glaser and Strauss (1967).

The Setting

The mathematics education research community at this institution consisted of five professors, five graduate assistants, two graduate students who were not on assistantships, and three support staff members. It was a community in the process of re-defining itself; two of the professors had joined the faculty only a year before and two veteran faculty members were reducing their involvement in the department, one for medical reasons, the other in order to take on new administrative duties.

This community was a part of the Department of Curriculum and Instruction at what had once been a teachers' college but had, fifteen years earlier, merged with a neighboring university and become its College of Education. The administration of the college and the university placed a strong emphasis on research and the mathematics education group contributed much to the high research profile of the department, having three funded multi-million dollar grant projects.

The graduate students were studied in several settings within this community. All four were students in a doctoral seminar taught by one of the professors. The seminar enrolled ten students, including all but one of the doctoral students in the department as well as students from a related program in learning technology. All four were also involved in the research projects as graduate assistants. I was able to observe them beyond the classroom--in project meetings, in conferences with the professor, in collaborative sessions with one another, and in professional activities such as conference presentations.

The Participants

The four students represented a range of experience within the math ed doctoral program, from a first-year student to one writing her dissertation proposal. Their degrees, when completed, would bear different labels. They brought a variety of background experiences with them as well, from the areas of business, teaching, and mathematics (see Table 1). The main thing these students had in common, beyond their participation in the same graduate program, was the experience of being mentored, in varying degrees, by Peter Gordon, the professor in the study. It was not unusual to hear Peter calling off each name, much as a parent calls his children: "Louise, Carol Ann, Sue, Lisa--come in here." As Louise said with a smile, "He just 'rounds up the usual suspects'."

Table 1

Summary of Students' Educational Backgrounds and Experiences

	Lisa	Sue	Carol Ann	Louise
Advanced Degrees	M.B.A.	M.Ed. (math)	M.Ed./Ed.Sp. (education)	M.A. (math)
Teaching Experience	1 yr.	7 yrs.	18 yrs.	8 yrs.
Degree Program	Ed.D. (math ed)	Ph.D. (education)	Ed.D. (curriculum & instruction)	Ed.D. (math ed)
Year in Program	1	2	2	3

Peter Gordon's relationships with graduate students, his mentoring activities, and the influence of his research agenda on his students and his community, both locally and globally, became some of the central themes in this study. Two of the student informants, Louise and Carol Ann, officially worked with his grant project; Sue and Lisa became involved with it through their class projects. He was the instructor for the doctoral seminar, Cognitive Theories in Mathematics Learning, in which all four informants participated. It is impossible to look at these students' processes of enculturation into the disciplinary discourse without also examining this professor's role as catalyst.

Professor as Mentor in the Community

Even though Peter, as most of his students and colleagues called him, had been a part of this community for only two years, he had already had a strong defining effect on it. He had high expectations for his students, matched by his own sense of obligation to them. Peter's standards for his students included expectations that they would be actively involved in his research, write for publication and present at conferences, collaborate with him and with one another, think like mathematics education researchers, participate actively and critically in class, and take responsibility for their own learning.

Peter's research agenda accounted for a great deal of the activity within the community, especially that involving the graduate students in this study. He readily admitted that his students' research focuses would be shaped by his own interests and one of the student's described him as having "tunnel vision" when it came to the job she might eventually have:

> He says "You can't leave here unless you've published--how will you get a job?" And I think "I could get a job *now*." We're talking about two different things here. He has tunnel vision: research jobs.... I never really knew what people meant by a "research institution" and now I do.

Peter's own research was such a central part of who he was, what he did, and how he did it that he had little time or energy left to support students in pursuit of agendas substantially different from his own. To work closely with Peter Gordon was to learn to do what he did.

Finally, Peter's relationship to the broader math ed community was an important resource for all his students, particularly those working with him beyond the seminar classroom. By all accounts, Peter was an active, influential member of the greater community of mathematics education researchers. His own view of his place in his professional community differed somewhat from that of his students, but all agreed that he knew and was known by the key players in the field.

His personal connections to other community members around the world were a result of several things. He had continued relationships that began for him in graduate school, with his major professor and with fellow graduate students who had also moved on to academic appointments across the county. And he continued to work with former colleagues from the institution where he had previously taught. He was active in several professional organizations, including AERA and an international organization for the Psychology of Mathematics Education (PME), which afforded him connections with researchers in Europe, Africa, the Middle East, and Australia. And Peter had been actively publishing for the past ten years, writing for math ed journals, journals in educational research, and producing four books.

Although he was reluctant to discuss his contributions to the field, he did admit that in some respects, particularly in terms of the math reform movement, he had been "very much mainstream and... very influential." However, he saw his present role as more of a challenger to what had become "the religion of constructivism." One colleague said of him that he seemed to be "always pushing the envelope." So, while he personally knew many of the main figures in math ed and was one of them himself, his philosophy and research activities were somewhat outside of the mainstream. Whether they proved to be in the vanguard had yet to be seen.

To his students, however, he *was* math education. One student said "Peter represents the field, basically, at this point.... I really think that he represents the math ed field and I think that he's trying very hard not to direct us to think the way he thinks, but the field is

thinking this way...." None of them had heard of him before coming to the university, but all had been convinced of his stature in the field quite early on. One of them spoke of the positive response it generated for *her* when she mentioned upon meeting someone at a conference that she was Peter Gordon's student; his was a powerful name to drop.

Because Peter was so closely networked with others in his field, he was able to provide his students with access to established community members outside the local university. He did that, basically, in two ways. He had access to papers before they were published and used many of those as readings in his class, thereby giving the students an inside view of the on-going conversation of the discipline. Also, he frequently received visits from researchers from all over the world. In the two years since he had been there, ten colleagues had paid campus visits. Only one of them was American; the rest represented Germany, the Netherlands, Greece, South Africa, and Australia. During each visit, Peter made sure graduate students had opportunities to talk and work with the visiting researcher.

One of the most interesting events that I witnessed during my data collection was what the students had dubbed "the power weekend." Peter had arranged for several colleagues from all over the world to come to campus for a weekend to consult with him on his research project. Among the twelve visitors in attendance were representatives from the National Science Foundation, five American universities, and two foreign countries. All four of the students in my study were present during this three-day meeting.

Peter's strong connection with his professional community had an interesting effect on his own writing process. He usually wrote *to individuals*, rather than to a broad, general audience of math ed researchers.

> Everything's motivated, I think, by the fact that I'm in a conversation, really.... So when I'm writing I'm making points for particular reasons because of what's going on in that conversation.... But what I've found is interesting. I've always written to specific other people, to particular theoretical perspectives and here's the bizarre thing in my career: I do that and I find I have some influence, but [I] don't necessarily influence those people [I've written to] but all these [other] people sitting on the sidelines, watching what's happening, and I find that quite mystifying.

Method

Data Collection

I collected data over a 5-month period during the spring semester of 1994. Techniques included observations (of classes, conferences, research project meetings, and informal interactions), interviews (between six and twelve interviews with each major participant and single interviews with other members of the math ed group), and document collection (including drafts and revisions of course papers, conference papers, doctoral qualifying papers, and dissertation proposals). Miscellaneous sources of data included copies of the course readings with students' annotations, students' descriptions of their writing processes, students' logs of their experiences at a conference (the American Educational Research Association--AERA), and responses to Joseph Williams' (1984, 1992) model of socialization into a discourse community. Table 2 presents the distribution of data sources keyed to the major participants.

Data Analysis

Data analysis occurred throughout the study, simultaneously with data collection. This is consistent with Lincoln and Guba's (1985) suggestion that in naturalistic studies "data analysis must begin with the very first data collection in order to facilitate the emergent design, grounding of theory, and emergent structure of later data collection phases" (p. 242). A summary of my data analysis activities is presented in Table 3.

The primary method of data analysis was the constant comparative method (Glaser & Strauss, 1967; Lincoln & Guba, 1985) which involves categorizing information gathered during the research. This method was applied to field notes, transcripts of interviews, and documents. Even during the early phases of the research I began to code the field notes and transcripts as I produced them. Initially, I did this by making notes in the margins, but eventually I used a computer program, The Ethnograph, to organize the coded data. With the aid of this program, I

Table 2
Summary of Data Sources Keyed to Major Participants

Sources	Peter	Louise	Carol Ann	Sue	Lisa	
observations (total) (25)	20	22	17	16	16	
3810 class (13)	13	13	9	13	13	
project meetings (4)	4	3	3	2	2	
conf. presentation (2)		1	1			
tchr./st. interaction (4)	3	3	3	1		
st./st. interactions (2)		2	1		1	
interviews (43)	6	12	7	7	6	
documents (73)	8	42	3	8	12	
annotated readings (25)					25	
AERA log (2)		1		1		
desc. of wrtg. proc. (3)		1		1	1	
Williams model response (5)	1	1	1	1	1	
class readings (40)						
Total # of sources (216)	35	79	28	34	61	

Table 3
Data Analysis Procedures

Phase	Focus	Techniques
1	Refine methodological procedures for recording field notes Recognize initial patterns in community relationships and in discourse development	Weekly reviews of MN & TN Weekly production of MM Peer debriefing Weekly reviews of FN & TR Weekly production of TM
2	Search for patterns in discourse development Develop working hypotheses	Weekly reviews of FN & TR Weekly production of TM Constant comparative method
3	Refine and develop hypotheses	Weekly reviews of FN & TR Weekly production of TM Peer debriefing Constant comparative method
4	Check credibility of report Revise report to reflect participants' comments	Member check conferences

Note: MN = methodological notes; TN = theoretical notes; FN = field notes; TR = transcripts

could access coded, categorized data quickly. This program allowed me to access either a single coded transcript or set of field notes or to search through multiple transcripts and field notes for all segments designated by a single code. The coded segments were compared with others in their assigned category in order to generate the theoretical properties of the category, as Glaser and Strauss (1967) suggested. This led to the development of two kinds of categories, descriptive (based on categories the participants themselves recognize and use) and explanatory (categories I developed to explain what I was seeing) (Lincoln & Guba, 1985). Once the theoretical properties of a category began to suggest themselves, I attempted to describe them in theoretical memos. I then moved to comparing and combining categories with one another.

Discussion

Two overarching categories emerged under which most of the other categories were subsumed: (1) what students had to learn in order to be competent in their discipline's discourse (identified initially as the conversations and conventions of the discipline) and (2) how the students developed these competencies, beginning with the specific learning opportunities each student had and generalizing from those to more abstract categories such as exposure, practice, feedback, and the effects of mentoring. One of the most important things these students came to recognize was the conversational nature of the discourse they were attempting to learn. The opportunities they had to experience the conversation were critical to their development, were often a result of their association with Peter Gordon, and were a defining characteristic of their graduate experience. This paper examines some of the data that demonstrates how these students came to acknowledge the conversation in their discipline, beginning with what Lave and Wenger (1991) call "legitimate peripheral participation" which equipped them to move beyond the periphery to a position within the inner circle of the discipline, and how this awareness of the conversational nature of the discourse became internalized as an heuristic of purpose and audience that shaped the production of their texts.

Learning Opportunities

The four students experienced a variety of activities during the semester that exposed them to the discourse of their professional community and provided them with opportunities to learn that discourse. Table 4 lists those discourse-related enculturation activities and indicates the ones each student participated in as well as which activities afforded opportunities for collaboration.

Table 4

Discourse-related Enculturation Activities

	Lisa	Sue	Carol Ann	Louise
assistantship	X(C)	X(C)	X(C)	X(C)
research project	X(C)	X(C)	X(C)	X(C)
class participation	X(C)	X(C)	X(C)	X(C)
class paper	X	X		
"power weekend"	X	X	X	X
conference paper		X(C)	X	X(C)
qualifying exam			X	
qualifying paper				X
dissertation proposal				X
article			X(C)	X(C)
editing jobs		X	X	X

Note. X=student participated in one or more of these activities during the semester. (C)=activity involved collaboration.

Four of the activities were experienced by each of the students: the assistantship, work on a research project, participation in the 3810 seminar, and the "power weekend" with the project consultants at the end of the semester. The nature of the assistantship experience for Lisa and Sue differed somewhat from that of Carol Ann and Louise because they worked on a different

project and with different professors, not with Peter and his project. But, because of their assistantships, all four were regularly in the departmental suite and involved in the activities and conversations that went on there. Because their assistantships included working on research projects, they had the opportunity to learn the research process by doing it. For Louise and Carol Ann, this meant on-the-job training in qualitative research methods and indoctrination into Peter's emerging theoretical position. Sue and Lisa did not play as integral a part in their projects, acting more in the roles of graduate assistants than co-researchers. In Lisa's case, this was due in part to her inexperience. Sue's significant contribution to the project was primarily in the realm of technology, an area in which she already had a high degree of competence. Neither of them ever spoke up in project meetings nor did they appear to be particularly involved in the decisions regarding the research project, although Sue's behind-the-scenes involvement was crucial. It was not "their" project in the same sense that Louise and Carol Ann shared ownership with Peter on his project. To Lisa and Sue, their assistantships and their work on the research project were their jobs; to Louise and Carol Ann, they were the source of the research that would lead to their dissertations.

Both the assistantships and the research projects, which were often one and the same, involved collaboration. There was intense collaboration among Peter, Louise, Carol Ann, and the project teacher in terms of research design and data collection, and Carol Ann and Louise were on the road to writing companion dissertations, which would involve collaborative data analysis. Sue and Lisa also had opportunities to work collaboratively with the research professors and with the other members of the project team, but, again, not to the degree that Carol Ann and Louise did.

Participation in the 3810 seminar, even for those students who were auditing, involved reading the assigned articles, participating in the class discussions, and completing several out-of-class writing assignments. (Louise did only one written assignment; Carol Ann did only two.) These short assignments were all collaborative, with Peter taking care to pair experienced students with inexperienced ones each time. The assignments included analyses of

two tapes from Peter's research classrooms, an analysis of the philosophical and research perspectives demonstrated in three articles, and a review of an in-process article Peter was writing. Table 5 presents the four participants' collaborative pairings for each of the assignments completed.

Table 5

Collaborative Pairings for Short Class Assignments

	Status	Louise	Carol Ann	Sue	Lisa	
Louise	official auditor				review	
Carol Ann	unofficial auditor				article analysis	
Sue	credit				tape #2	
Lisa	credit	review	article analysis	tape #2		
post-doctoral student	unofficial auditor				tape #1	
technology student #1	unofficial auditor					
technology student #2	official auditor			tape #1		
technology student #3	credit			article analysis		
math educ. student #1	official auditor			review		
math educ. student #2	credit		review			

Only the students who were taking the course for credit (in this case, Sue and Lisa) produced the major course project. They were required to turn in brief pieces throughout the semester that reflected their process and progress toward the final paper, beginning with a one page proposal, due their second class meeting, followed by a longer piece of approximately ten

pages. The final paper was expected to be twenty or more pages. Their topics were negotiable, according to Peter. He discussed with them their choices, in and out of class, and gave them written feedback on each piece they turned in to him. He also requested that they discuss their progress with the class at certain points and that they make a final oral presentation on the last night of class.

These students' degrees of involvement in the "power weekend" varied. On the only day that I observed of the three-day event, Louise and Carol Ann were "on the program," as it were, because they were two of the researchers involved in the project being discussed. Louise was primarily responsible for choosing the tape segments that would be shown and Carol Ann introduced each segment. They sat at the front of the room, beside Peter. Sue and Lisa were involved in making runs to the airport to pick up in-coming visitors or deliver those who had to leave, taking the lunch orders, and making sure things ran smoothly so they were in-and-out of the conference room. Sue had been more involved in the actual discussions and presentations the day before, when the project she worked with was presented. For the most part, however, she and Lisa observed; only Louise and Carol Ann actually participated in the conversations that occurred on the day I observed.

Three of the students wrote and presented conference papers during the semester. Sue presented at two conferences, with one of the papers she first-authored winning an award for best multi-media paper. She wrote that first paper primarily alone, but the second paper was a collaborative effort with the visiting professor from Greece (who returned home before the paper was completed). This second paper was presented at AERA.

Louise also presented a paper at AERA, her second one. Her first presentation, the previous year, had been Peter's paper that he asked her to give as a convenience to him, because he was involved in several sessions at that meeting. The second paper was also a result of Peter's research, presenting his research methodology for the first time. He had requested that she write that paper for AERA presentation several months before. She spent much of the semester writing and revising and, finally, collaborating with Peter on a revision;

he became second author on it. At the end of the semester, Peter was working on another revision for publication as a journal article; on that version, he would be first author and Louise would be listed second.

Carol Ann did not present at AERA during the study; in fact, she attended the conference for the first time that year, as did Lisa. However, she did present at two NCTM conferences, the national meeting and one regional.

Louise and Carol Ann were the only two students who had progressed far enough in their program to be involved in the qualifying process. As mentioned earlier, Carol Ann successfully completed her exams and Louise finished her qualifying paper and began work on her proposal.

Only Louise and Carol Ann, again, participated in activities involving writing articles for publication. The two of them began collaborating with the project teacher on an article they intended to submit to the NCTM yearbook; however, that moved to the back burner as the pressures of the semester increased. Louise's conference paper also falls in this category since it was destined to go out to journals when Peter had completed his work on it.

The final activity listed is editing jobs. Both Sue and Louise edited articles written by colleagues of Peter's for whom English was a second language. Carol Ann served on the editorial board for an NCTM journal. She also worked with Peter, editing a document he had written for a more general audience than he was accustomed to addressing.

Acknowledging the Conversation

One of the steps a student must take before she can enter the professional conversation is recognizing that one exists. This is related to audience awareness but goes beyond it; it is an awareness that not only will specific people be reading and responding to what she has to say when she writes, but that everything she reads is written to specific people. The professionals in the field are talking to, arguing with, and attempting to convince each other through the literature. The literature is a conversation and these students needed to develop

the same awareness Peter had that "Everything's motivated... by [the idea] that I'm in a conversation."

Peter's students had an atypical opportunity to experience the conversational nature of the discourse. Unlike many graduate students who witness it from the sidelines and read the history of disciplinary conversations, with at least the buffer of the year or two it takes an article to reach publication, these students were plunged into the middle of the conversations *as they were going on*. Peter's connections to the network of math education researchers provided the access. In his class, they got to observe (and participate in, if they dared) the actual negotiation that shaped the shared assumptions and knowledge of the community.

Peter's preference for up-to-date articles was known by those students who worked closely with him. One of the reasons they seldom consulted ERIC was because any article indexed there was too old to be of interest to him. (Carol Ann: "...anything past '90 you can't use, you know; it's old--old news.") They learned early that the way to get access to current research was to write to known researchers in the field and ask if they had any papers "in-press" that they would share. Papers picked up at conferences were also fair game because they contained information that would not appear in published form for one or two more years.

Peter himself provided them with current articles. He had access to them in pre-publication form because he reviewed many of them and because his colleagues would send him copies of their drafts. He was on a first-name basis with the authors of most of the articles his students read during the semester ("I know _____, and I think what he would say to that is...."). Of the forty articles assigned, twelve were in pre-publication form.
The articles themselves suggested a kind of network; a core group of authors tended to cite one another often. And before the semester was over, the four students in the study had an opportunity to connect the authors' names with faces and personalities. Six of the nine major visiting participants in the "power weekend" had authored an article that the students had read during the semester. Table 6 illustrates the relationships among the students and the authors of the texts read during the course as well as the intertextual nature of the texts themselves. The

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Table 6

Student Connections to Established Community Members

Community Member	Worked with Peter Gordon	Textual Encounter	Campus Visit	Conference Encounter	Number of Citations
1	X		X		8
2	X	X			11
3	X	X	X		2
4	X	X			5
5	X	X			4
6	X	X			3
7	X	X	X		7
8		X			14
9		X			2
10	X	X			6
11		X			1
12	X	X	X		9
13		X	X	X	5
14	X	X	X		8
15		X			5
16		X			3
17		X			5
18	X	X			8
19	X	X	X	X	11
20	X	X	X		3
21	X	X	X		7
22		X			4
23	X	X	X		6
24	X	X			3
25		X			2
26	X	X			6
27	X	X			10
28	X	X	X	X	3
29	X	X			5
30	X	X	X	X	8

thirty individuals represented in the "Community Members" column were identified as active members of the math education community by the frequency with which they were cited in the literature assigned for course reading. Twenty-one of the thirty had worked with Peter Gordon in some professional capacity; twenty-nine of the thirty authored a text assigned for course reading; and twelve of the thirty met and conversed with at least one of the student participants, either through a campus visit or a conference presentation. These community members knew one another, often worked with one another, and regularly cited one another in their writing; indeed, their writings represented on-going conversations in the field--and Peter's students had the good fortune not only to meet the major contributors but to hear and participate in the conversations as well.

A discussion with Louise demonstrates her growing understanding of the conversational community she was beginning to penetrate. We were discussing an article that linked Dewey and Vygotsky and Louise began speculating about whether or not those two writers, who were contemporaries, had been aware of one another's work. Then she moved into commentary on the different groups within related academic research areas and who is listening to and talking to whom.

> **Louise:** It would be interesting to see if [Vygotsky] even mentions Dewey.... You put him in our context today and you think "Okay, I'm writing stuff right now; really what I write I think is most significant so if something doesn't relate to that do I even really look at it?" I mean, I don't look at teacher ed issues; they're really important issues but they don't fit my interests; it doesn't seem to fit with what I'm doing, blah, blah, blah.
>
> **Susan:** And there could be something over there that relates but that you don't know about....
>
> **Louise:** Exactly. And it's only if we began to stumble across one another at these conferences, or whatever, that we get a sense, or if someone cites it; you just hope that you can connect with that. Some of the things _____ [a job candidate] said last week when he was talking about the collective meaning--he used that notion of collective learning, which is the same thing that Peter's looking at but these guys don't communicate at all and yet they're coming up with some of the same issues. Now, of course, I don't think it started with them; it's just that they're beginning to use it....

Susan: Why don't they communicate? Are they just sort of in different groups?

Louise: Yeah.

Susan: Because I noticed that they're on the same program at AERA.

Louise: Yeah. I thought that was interesting, too. I'd never heard his name except maybe in passing in an article somewhere, but I've never heard Peter refer to him; he doesn't have a working/collaborative connection with him at all.

Implicit in her comments seems to be the idea that if Peter does not work with someone and has no connection with that person's research, then that research is not relevant to her interests and needs.

One of the reading sequences and the subsequent writing assignment highlighted the conversation for the students. Table 7 shows the articles and their relationships to one another.

Table 7

A Reading Assignment Sequence

Article	Relationship
Article #1	Peter reviewed the draft of this article and, on the basis of that reading, assigned it to the class. The class read the published version (but Peter had not, at that point).
Article #2	Peter wrote this in response to the draft of Article #1 he had reviewed. The students read the published version.
Article #3	This was a critique of Article #2; it was something of an attack on the position Peter had articulated there. It was "in-press," to be published along with Article #4.
Article #4	This was a draft of Peter's response to Article #3, solicited by a journal editor.

An excerpt from the field notes taken during the class discussion of Article #1 demonstrates the students' growing awareness of the conversation on which they were eavesdropping.

Field Notes

EDUC 3810, 1-27-94

Carol Ann, supported by Sue, tells Peter that they have discussed it and decided that he read the article and told the authors that they didn't have enough of "the social" in it and they had responded by just "sticking it in." He admitted he had written a 16 page review of the article.

Carol Ann: "Did you say `Where's the social?'"

Peter: "I said a lot of things."

Carol Ann: "Was that one of them?"

Peter: "Yeah."

Louise: "What would be the changes they would make? What would be different from what was in the [published article]? Is there any way you could map them? Is there like a correspondence of any kind with their original piece?"

Peter: "Oh, yeah."

Louise: "So it's almost in its final form?"

Peter: "The organization is basically the same."

Louise: "So could we go back to the original and see if the social was there?"

Peter: "Could you see the original?"

Louise: "No; could you? To see if it's there."

Peter: "They mentioned it but I don't think, probably, as much. I have to say that I spent three days writing this review; I took a lot of time. I did it as an open review and I sent it to them. And they responded that they thought the differences between us were purely semantic. (Growls and students laugh.) ...It was helpful, actually, because as a consequence, I ended up--the viewpoint that I was trying to articulate in the review I ended up writing in an article. An article started by writing that review."

Tech. Student #2: "Would it be possible to look at your review of this piece?"

Peter: "My review?"

Tech. St. #2: "Or the article that came from it."

Peter: "That is the article that came from it; I reviewed the previous draft."

Several voices: "No, *your* article that came from it."

Peter: "Yes. It was the [names well-known article that he wrote]; that's where it came from." (Looks at Louise as he says this. Louise seems amazed; she obviously is familiar with the article.)

Peter: "Well, let me tell you the whole story, because this goes on. I was thinking of including this anyway, but it all depends on if I get something drafted, which is very doubtful this semester, the way life is going. So I wrote that article putting forth an alternative view for this journal and it's become something of a notorious article and someone just, a philosopher, has just written a really swinging, 40-page critique of this same article. So I'm now writing my response to his critique, where I try to put the boot in again. So what I'd be happy to do is, if I can get the response done, is to share that with you and I would want you to react to my response if you would do this for me. So I was thinking of holding it back till then."

When Peter did share his response with the students, he asked them to write a review of it, "as if you were reviewing it for a journal." Initially, this assignment did not appear very successful for several reasons. First of all, because none of these students had ever reviewed an article for a journal, nor seen a review, they were somewhat confused as to what he was asking them to do; they had no model. Secondly, the content was extremely high-level, as was the discussion; the authors were arguing about philosophical points with which the students were unfamiliar. And finally, there were political issues involved; they were hesitant to take a critical stance toward something their professor had written. Nevertheless, the exposure to the debate in-progress was useful in developing a sense, for these students, of the on-going conversation in the field, even if they could not yet enter that conversation with confidence. And Peter took their comments seriously, almost completely revising the paper in response to them. He was particularly influenced by the suggestions they made about his tone and about the high level of philosophical discussion. He re-wrote the article to make it less confrontational and to include more explication, saying "I realized that other people would be reading it who were also novices in this field and that I needed to explain things a lot more." He asked Sue and another student who had given particularly helpful comments to look at the revised version for further feedback and acknowledged their help in the paper itself.

Lisa and Louise represent the two extremes among these students in terms of their awareness of the conversational nature of their discourse and their awareness of their audience. Lisa, at the beginning of the semester, was resistant to the idea that she would be writing to a very well-defined group of people, that she was not writing to a general audience but to an audience that defined itself, in part, by the exclusive nature of its discourse. She said:

> Well, usually when I write, I consider an audience that may not be into the whole math education thing. When I write anything, I was always taught "assume the audience knows nothing, so anyone can pick up this paper and understand."....Honestly, I don't want to write the way they do; I want to be able to just write plain, straightforward, so that anyone can read it, but I have a feeling that won't be possible--that's why I'm a little nervous about writing this paper for Peter. I mean, I won't use the words or the terminology and, to be honest, I don't want to. I'd rather it just be a paper that someone can read.

Louise, on the other hand, was much more attuned to who her audiences were. Even though she was writing her dissertation proposal, on one level, to four specific people (her committee), she saw those people as representatives of the larger audiences she hoped to address in her research writing.

> Well, there are probably two readers to consider. [The math educator who already is familiar with the things I'm talking about is one.] It doesn't matter how theoretical I can be on a personal level, if I want to write this paper for me, myself, and I, I can be as theoretical as I choose, but I can't take that paper then and ask just any journal to read it. You have to assume the reader has such a tremendous base in that particular area, so then you're dealing with maybe 100 people who could actually read it and maybe only about five who'd want to. So I have to consider, just from the perspective of the math educator, I have to think about that. Because there are lots of math educators who don't get into _____ at the level that I did for the area paper. And then the other audience is more general, the more general educational researcher, such as [one of my committee members], who may not be as interested in all the cognitive stuff but will want to see some sort of tracking of mathematical learning.. So I'm sort of trying to accommodate both, hopefully.

Internalizing an Heuristic of Purpose and Audience

Peter maintained that he did not have any "rules" for writing, that everything had to be considered in context. He was only willing to talk about specific cases, specific papers he had written. What he did have, however, was a highly developed

sense of purpose and audience every time he wrote. This had evolved into a kind of heuristic for him; he constantly asked himself "Why am I writing this and who am I writing to?" This grew out of his sense of the conversation in which he was participating ("When I think of it, I think of where those people might be coming from and that will influence how it gets done."). His students were in the process of developing a similar heuristic, one dependent on the recognition of the conversational nature of the discourse; once students begin to understand that there is a conversation going on among individuals in the field, they can then begin to ask themselves how they can address those individuals in order to say what they want to say.

Peter was aware of the differences in addressing an audience of researchers and an audience of teachers.

> [Writing for an teacher audience] is a different genre of writing. I'm not very good at it, but I have done a few. It's hard for me to write that way.... It's different in that you have to work much harder to draw the reader in. The reader won't give you as much slack as a research audience will, so a common device to use, for example, is to start off with a scene in the classroom or something that's happening that looks "neat" mathematically, to start with that to draw them in. But I also happen to believe that it's possible to push on these [challenging] issues in that forum, although you do it in a very different way.

Lisa, as seen in the discussion of the conversational nature of the discipline, had not yet made the shift from writing for a general audience to writing for math ed researchers. Because she did not have a sense of who her audience was, she could not begin to use such an heuristic to make rhetorical decisions. Sue, on the other hand, had learned, from collaborating with a visiting professor from Greece who had come to study with Peter, that she was, indeed, making an argument. She described her observations of the professor's writing process:

> Finally she said, "Why would anyone want to read this paper?" And that's a good question. I think that was the most productive thing. And then she built up a whole argument about why anyone would want to read the paper. We decided that it had to be on a more global level than "this is the activity, this is what we found, this is how we changed it".... She constantly asks herself "why? why? That's not strong enough; that's not a good enough argument."

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Peter said on several occasions to one or another of the students that a paper was good, but that it was not "publishable." Though he never was much more explicit than that, in some instances what he seemed to be talking about was the voice students projected and the audience addressed. For example, Sue envisioned her paper as addressed directly to Peter; it was basically a proposal for the project she wanted to do related to his research. The tone was informal in many places and she made assumptions about what was "taken-as-shared" between the two of them. She had not written a paper with publication in mind, nor did she think that was expected of her. She expressed frustration at his comment that it "was not written in a publishable style."

> Overall, this has been a most difficult semester. Trying to figure out style with absolutely no guidance from anyone about writing is very difficult. Peter acknowledged this and said that he hadn't written any papers since tenth grade. One thing that really bugs me is that we are graded on and need to use our writing skills and yet we have no instruction. On the other hand, we NEVER use all of the math courses that are required and that are killers. This makes no sense to me.

Upon reading my notes on Peter's interview, Carol Ann picked up on this issue and, aware of the necessity of shaping a piece of writing for particular audiences and forums, wondered how she was supposed to learn to do it.

> I... thought his ability to read an audience was interesting. That's a skill; you learn it by doing it a lot. And I want to ask him "So, do I get the advantage of that expertise? Are you going to help me decide, if I want to submit here, what this needs to look like? Or, once I do something, where my best chance is? Or is that something I also must, through the process of trial and error, error, error, error, find out for myself?" I'm going to point blank ask him that. And there's this thing for next year's national meeting; if you want to do a research presentation, the deadline's May 1. And I'm going to draft out a proposal and give it to him and see if he thinks it's ok and see what role he's going to take in us trying to get accepted to do things, or if we're just supposed to run off and do this. I'm curious about just how much he's going to be involved.

Louise was the most adept at using this heuristic. Her awareness of her various audiences for her dissertation was seen in an earlier discussion. As she worked on the AERA paper, her remarks demonstrated a strong sense of who would be reading her paper and why she was writing it in the first place.

> I actually wrote a very straightforward comment about "This is the purpose of this paper"--I just did a straight purpose statement and then just elaborated a few points and threw in something else. I was trying to fit the case studies in without feeling like these people were going to be clueless as to why I'm referencing the case studies; quite frequently throughout the paper the case studies are referenced. So I had to figure out a way to sort of ease that in. So I threw out the first page of the original rough, the last version I had, and I put in his theoretical and pragmatic issues that I think he wanted to see; I just cut-and-pasted them and didn't bother with it. And from there I felt like I could easily line up the reasons why I'm having the current discussion. It seems like it works.... I like how I changed the spacing for the analysis part. In the book, everything's double-spaced; but for clarity purposes, so someone that's reading this would know it's the analysis, I went to single spaced.... And I felt like this organizer needed to be here. After you see the sample, you have the analyses, then something, then the second. Those two samples serve as the discussion. They sort of are situated in this paper to serve as a way of talking about the method; that's why those are there.

In terms of the development of an awareness of the conversational nature of the discipline and the subsequent development of an heuristic for purpose and audience, these students were, not surprisingly, at different points. Lisa resisted the conversational nature of the discourse she was trying to learn, insisting that she should write to "people who know nothing about math ed." Sue was capable of recognizing who her audience was when she was writing pieces that were obviously going to be public, such as conference papers. However, she experienced some confusion when writing her course paper--she chose to write it directly to Peter rather than seeing it in the larger context of the disciplinary conversation. Louise and Carol Ann were both highly aware of the conversational nature of their texts. For Carol Ann this awareness came partly from her experiences as an active math education practitioner. She knew what it meant to write to particular audiences; what she needed to do was shift from addressing teachers to addressing researchers. Also, both she and Louise, by virtue of their close working relationship with Peter, had the advantage of knowing personally many of the major contributors to the research conversation.

The Means of Discourse Competency Development

These students learned (or were learning) to produce the discourse of the mathematics education research community through several important experiences.

They had exposure to the products of the professional conversation, exposure to the process of the conversation, opportunities to try the discourse and get feedback on their attempts to use it, and occasional explicit instruction in producing acceptable written discourse--all under the guiding hand of a mentor who was an active, influential member of the community. Another important quality of their graduate education experience was the close connection between the writing they did as students and that they would do as professionals.

Because Peter Gordon was actively involved in the international community of mathematics education research and had developed his own network of contacts, he was able to introduce his students to the conversations of the discipline as they were occurring, rather than from the distance of time it takes to bring an article to publication. By using in-press articles, by requesting that his students read and review his own writing-in-progress, by inviting colleagues for campus visits and providing his students opportunities to meet and talk with these established members of the field and to observe his own interaction with them, by collaborating with students on research and writing projects, this professor developed in his students an awareness of the conversational nature of the discipline's discourse and provided them opportunities to practice that discourse in a relatively safe environment.

The interaction of the local community (colored by Peter's influence) reflected the reality of the larger community in several important ways, including expectations of and experience with collaboration. Students came to think of themselves as participants in a writing/research community, not as individual scholars or researchers with individual agendas. The feedback they received from the professor and from one another served the same purposes as that within the professional community--response and engagement rather than correction and evaluation. And the writing tasks that students faced were similar to those that they would be expected to produce as functioning members of the community--less focused on showing their mastery of

content and more focused on making a contribution to the knowledge of the field. In fact, these students spent a great deal of time on "real " writing, such as conference papers and articles, and approached their course writing assignments with an eye toward publication as well.

An obvious implication for doctoral students' education is the importance of the mentor professor's position within the community. Not all graduate professors can provide their students with the opportunities that Peter provided his. Only those who are actively involved in the professional community themselves and who are willing to share their connections with their students can do this. Students of powerful, influential members of a discourse community have entree into the inner circle, but they must make certain compromises in order to gain the benefits of such an association. Primarily, they must buy into the major professor's research agenda and this sometimes involves abandoning their own initial interests. In exchange, they become first observers of, then participants in, the critical, on-going conversations of the discipline. And they carry with them the valuable label of "Peter Gordon's student." As Louise put it:

> I'm being trained by one of the best in the field. I can't leave here without knowing a lot of what Peter knows; I can't do that--that would not be a good representation of Peter. So I have an obligation to the field now and to Peter.

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